while continuing the control relating to the distance between said probe and said sample based on said servo control system at least when said probe is made to approach the sample surface and during measurement at said sampling points.

REMARKS

Applicants appreciate the Examiner's acknowledgment for the claims for priority under 35 USC 119 and safe receipt of the foreign priority document.

Applicants have amended the specification as required by the Examiner.

Concerning the 35 U.S.C. § 112, second paragraph rejection of claims 1, 8 and 22, each of these claims has been amended to overcome the rejection. In particular, the specification sets forth that the servo control system is constantly maintained in the active state and servo control relating to the expansion and contraction of the piezoelectric element 61 is continued at the time of movement between sampling positions and at the time of measurement at a sampling position. See page 32, lines 15-18 of the specification, for example. Further, at page 32, lines 19-23, the Applicants explain the meaning of the phrase "servo control is continued". Therefore, the phrase finds support in

the specification. Since the claims have been amended to conform to the explanation provided in the specification, the 35 U.S.C. § 112, second paragraph rejection should be withdrawn.

Concerning the objections to the terms "wide" and "high" in claims 6, 7, 12, 13, 14, 16, 19 and 22, each of these claims has been amended to delete the term and therefore the rejection of these claims under 35 U.S.C. § 112, second paragraph should be overcome.

Independent claims 1, 8, 19 and 22 have been rejected under 35 U.S.C. § 102(b) as being anticipated by Kajimura et al, U.S. Patent No. 5,394,741. Further, independent claims 14 and 16 have been rejected under 35 U.S.C. § 103(a) as being anticipated by Kajimura et al in view of Hosaka et al, U.S. Patent No. 5,467,642. The dependent claims are rejected as being anticipated by Kajimura et al (claims 20 and 23) or by Kajimura et al in view of Hosaka et al (claims 2, 3, 4, 5, 10 and 11) and further in view of Okada et al (claim 18). Reconsideration of these rejections is requested for the following reasons.

The Examiner sets forth on page 5, last paragraph of the Office Action that in examining the claims, the limitation "wherein the state of the servo control by said servo

controller is continued" has been ignored. However, the limitation regarding the state of the servo controller being continued should have been given patentable weight in view of the explanation provided in the specification for the limitation. Therefore, the rejection of claims 1, 8 and 22 as being anticipated by Kajimura should be withdrawn. Further, the rejection of dependent claims 2-7, 9-13, 23 and 24 should also be withdrawn since each of these claims is dependent on one of claims 1, 8 and 22 as a base claim.

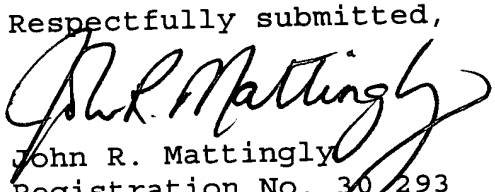
Regarding independent claims 14, 16 and 22, each of these claims is patentable over the combination of Kajimura et al and Hosaka et al. In particular, claim 14 sets forth approaching and separating means for making the probe approach the surface of the sample at the sampling position and making the probe separate from the sample surface during movement between sampling positions. Claim 16 is similar and includes steps for making the probe approach and separate from the sample surface. Claim 14 further includes an auxiliary movement mechanism for making the probe move in tandem at an equal speed in the same direction as the scan motion of the movement mechanism when the probe is made to approach the surface of the sample for measurement at the sampling position. Similarly, method claim 16 includes a step of

causing the scan motion for tandem movement by an auxiliary movement mechanism when the probe approaches the sample surface for measurement. The combination of Kajimura and Hosaka et al does not disclose these means or steps as set forth in claims 14 and 16. Accordingly, the rejection of claims 14 and 16, as well as the rejection of claims 15, 17 and 18 (dependent claims) should be withdrawn.

With respect to claim 19, Applicants set forth in the claimed combination an approaching and separating signal supplying means in combination with a control circuit that generates a control voltage based on the differential signal that is applied to the piezoelectric element to control the approach and separation movement. The claimed differential signal is calculated by a difference between a voltage signal output by combining a reference distance voltage signal and an approach and separation voltage signal, and a detection signal that is output by the displacement detection mechanism for detecting displacement of the probe in a height direction with respect to the surface of the sample. This combination is not set forth in Kajimura et al, therefore the 35 U.S.C. § 102(b) rejection of claim 19 should be withdrawn. Further, claims 20 and 21, which depend from claim 19, should be found patentable over Kajimura et al.

In view of the foregoing amendments and remarks, reconsideration and reexamination are respectfully requested.

Respectfully submitted,



John R. Mattingly
Registration No. 30,293
Attorney for Applicants

MATTINGLY, STANGER & MALUR
1800 Diagonal Road, Suite 370
Alexandria, Virginia 22314
(703) 684-1120
Date: December 19, 2002

MARKED UP VERSION OF THE SPECIFICATION

Pages 9 and 10, the paragraph bridging these pages from page 9, line 20 to page 10, line 11, the marked up paragraph is as follows:

--Further, since the probe is separated (or moved backward) at locations other than the sampling positions, it is necessary to suspend the control by the servo control system at the time of separating. The reason is that even if a backward signal is given to the actuator to control the height of the probe, if the above servo control is being continued, since the distance between the probe and sample will be held constant, the separating movement cannot be realized. Therefore, when moving the probe to the next sampling position and again approaching it to the sample surface, it is necessary to approach it slowly and carefully while producing an intermittently generated triangular drive signal and controlling the position in the height direction of the probe as shown by the time charts of FIG. 5 [or FIG. 8] in the publication. Therefore, the problem arises that time is taken for the probe to approach to the sample. In addition, since the above approaching movement of the probe is necessary, the control of the probe movement becomes complicated.--

Pages 28 to 30, the paragraph bridging these pages from page 28, line 24 to page 30, line 4, the marked up paragraph is as follows:

--The cantilever 15 arranged above the sample 13 is provided with a detection system for detecting the height position of the probe 14 with respect to the sample surface (Z-direction displacement). The detection system is [an]a light lever type photo detection system comprised using the flex deformation of the cantilever 15 and a laser beam. The light lever type photo detection system is comprised of a laser light source 22 for focusing a laser beam 21 on a reflection surface formed on the back of the cantilever and a 4-division photodiode 23 for example receiving the laser beam 21 reflected at the back. The laser light source 22 and photodiode 23 are for example provided at the bottom of the piezoelectric element 61 and operate together along with the operation of the piezoelectric element 61. The reflected spot of the laser beam 21 reflected at the back of the cantilever 15 strikes the 4-division light receiving surface of the photodiode 23. If the distance between the probe and the sample changes in the state where the probe receives the atomic force from the sample surface, the atomic force

received by the probe will change, the height position of the probe 14 will displace, and the amount of flex deformation of the cantilever 15 will change. The reflected spot of the laser beam 21 at the light receiving surface of the photodiode 23 displaces from the center position in accordance with the amount of change of the amount of flex deformation of the cantilever 15, so the height position of the probe 14 (cantilever 15) with respect to the sample surface is adjusted by the later mentioned servo control system so that the distance between the probe and sample is held at a set constant reference distance. Due to this, the position of the reflected spot of the laser beam 21 at the light receiving surface of the photodiode 23 is held at the above center position in accordance with the set constant distance between the probe and sample.--

MARKED UP VERSION OF THE CLAIMS

1. (Once Amended) A scanning probe microscope comprising:

a cantilever having a probe close to a sample surface;

an actuator provided with the cantilever for changing a distance between said probe and said sample;

a displacement detection system for detecting displacement of said probe; and

a servo controller outputting a control signal for controlling the operation of said actuator based on a detection signal output by the displacement detection system and a signal relating to a reference distance and holding a distance between said probe and said sample at said reference distance in measurement at a sampling position;

wherein said probe scans said surface to measure said surface while holding the distance between said probe and said sample at said reference distance at each of a plurality of said sampling positions;

said scanning probe microscope further comprising;

an approaching and separating means for controlling the operation of said actuator so as to make said probe approach to the sample surface for measurement at each of said sampling

[points] positions and then make said probe separate from the sample surface;

wherein the state of the servo control by said servo controller is continued at least when said probe is made to approach the sample surface and during measurement at said sampling points.

6. (Once Amended) A scanning probe microscope as set forth in claim 4, comprising:

a movement mechanism for making said probe scan the sample surface over [a wide] an area;

wherein, when said probe scans said sample by on the operation of said movement mechanism and said second piezoelectric element makes said probe extend to the surface of said sample for measurement at said sampling position, said first piezoelectric element makes said probe move in tandem at an equal speed in the same direction as the scan motion by said movement mechanism and said first piezoelectric element functions as an auxiliary movement mechanism.

7. (Once Amended) A scanning probe microscope as set forth in claim 1, wherein:

said probe has a [high] predetermined aspect ratio and said probe measures a surface with a [high] predetermined aspect ratio.

8. (Once Amended) A method of measurement performed by a scanning probe microscope provided with a cantilever having a probe close to a sample surface, an actuator provided with said cantilever for changing a distance between said probe and said sample, a displacement detection system for detecting displacement of said probe, a servo controller for outputting a control signal for controlling the operation of said actuator and holding a distance between said probe and said sample at said reference distance in measurement at a sampling position based on a detection signal output by the displacement detection system and a signal relating to a reference distance, and a movement mechanism for making said probe scan the sample surface, and said method of scanning said surface by said probe to measure said surface while holding the distance between said probe and said sample at said reference distance at each of a plurality of said sampling positions,

further said method of measurement comprising:

a step of making said probe approach to the said sample and separate from said sample to obtain measurement data at each of said sampling [points] positions while continuing the state of servo control relating to the distance between said probe and said sample by said servo controller at least when said probe is made to approach the sample surface and during measurement at said sampling points.

12. (Once Amended) A method of measurement of a scanning probe microscope as set forth in claim 8, further comprising a step of making said probe scan the sample surface over [a wide] an area.

13. (Once Amended) A method of measurement of a scanning probe microscope as set forth in claim 8, wherein;

a probe with a high aspect ratio is used as said probe and said probe measures topographic features with a [high] predetermined aspect ratio formed on a semiconductor substrate.

14. (Once Amended) A scanning probe microscope comprising:

a probe close to a sample surface; and

a servo controller for holding a distance between said probe and the surface of said sample at a reference distance during measurement at a sampling position;

wherein said probe scans said surface to measure said surface while holding the distance between said probe and said sample at said reference distance;

said scanning probe microscope further comprising:

a movement mechanism for making said probe scan the surface of said sample over [a wide] an area;

an approaching and separating means for making said probe approach to the surface of said sample at said sampling position and make said probe separate from the surface of said sample during movement between sampling positions; and

an auxiliary movement mechanism for making said probe move in tandem at an equal speed in the same direction as the scan motion of said movement mechanism when making said probe approach to the surface of said sample for measurement at said sampling position.

16. (Once Amended) A method of scanning performed by a scanning probe microscope provided with a probe close to a sample surface and scanning said surface with said probe to

measure said surface while holding the distance between said probe and sample at a predetermined distance,

said method of scanning being performed [when the] for a predetermined measurement area at the sample surface [is relatively wide], a plurality of scattered sampling positions are set in said measurement area, and scan motion by a movement mechanism is performed for measurement at each sampling point, and

said method of scanning is comprised of:

a step of making said probe separate from the sample surface during movement between sampling positions,

a step of making said probe approach to the surface of said sample for the measurement at each of said sampling positions, and

a step of causing scan motion for tandem movement at an equal speed in the same direction as the scan motion of said movement mechanism by an auxiliary movement mechanism when said probe approaches to the sample surface for measurement.

19. (Once Amended) A scanning probe microscope comprising:

a probe close to a sample surface;

a displacement detection mechanism for detecting displacement of said probe in a height direction with respect to the surface of said sample; and

a control circuit for control so as to hold a distance between said sample and said probe at said reference distance based on a detection signal output by said displacement detection mechanism and a signal relating to the reference distance; wherein

said probe scans said surface to measure said surface while holding the distance between said probe and said sample at said reference distance,

said scanning probe microscope further comprising:

a movement mechanism for making said probe scan the surface of said sample over a [wide] predetermined area;

a piezoelectric element for making said probe displace in a height direction of said sample with respect to said surface;

a reference distance setting means for giving a voltage signal determining said reference distance;

an approaching and separating signal supplying means for giving a voltage signal for making said probe approach to and separate from the surface of said sample;

a combining means for combining a voltage signal determining said reference distance and said approach and separation voltage signal; and

a subtracting means for calculating a difference between a voltage signal output by said combining means and said detection signal to output a differential signal;

wherein said control circuit generates a control voltage signal based on said differential signal and supplies said voltage signal to said piezoelectric element to control the approach and separation movement.

22. (Once Amended) A scanning probe microscope comprising:

a probe close to a sample surface;

a displacement detection mechanism for detecting displacement of said probe in a height direction with respect to the surface of said sample; and

a control circuit for control so as to hold a distance between said sample and said probe at said reference distance based on a detection signal output by said displacement detection mechanism and a signal relating to the reference distance; wherein

said probe scans said surface to measure said surface while holding the distance between said probe and said sample at said reference distance;

said scanning probe microscope further comprising:

a movement mechanism for making said probe scan the surface of said sample over a [wide] predetermined area;

a piezoelectric element for making a position of said probe in a height direction with respect to said sample surface match with said reference distance based on a servo control system at said sampling position; and

an approaching and separating means for making said probe approach to the surface of said sample at said sampling position and making said probe separate from the sample surface during movement between sampling positions;

wherein said probe is made to approach and separate to obtain data at said sampling position by said approaching and separating means at each of a plurality of sampling positions while continuing the control relating to the distance between said probe and said sample based on said servo control system at least when said probe is made to approach the sample surface and during measurement at said sampling points.